

BACTERIAL STRAIN LIST

TABLE A.2 Bacterial Strains

Strain	Genotype	Remarks
71/18	<i>supE thi Δ(lac-proAB)</i> F' [<i>proAB⁺ lacI^s lacZΔM15</i>]	A strain used for growth of phagemids. It makes high levels of <i>lac</i> repressor and is used for inducible expression of genes that are under the control of the <i>lac</i> promoter. This strain can be used for detection of recombinants expressing β-galactosidase fusion proteins (Messing et al. 1977; Dente et al. 1983; Ruther and Müller-Hill 1983).
BB4	<i>supF58 supE44 hsdR514 galK2 galT22</i> <i>trpR55 metB1 tonA ΔlacU169</i> F' [<i>proAB⁺ lacI^s lacZΔM15 Tn10(tet^r)</i>]	A <i>recA⁺</i> strain used for growth of λZAP and other λ bacteriophages. The F' in this strain carries <i>lacZΔM15</i> , which permits α-complementation with the amino terminus of β-galactosidase encoded in λZAP. The F' allows superinfection with an M13 helper bacteriophage, a step required for converting a recombinant λZAP to a pBluescript plasmid (Bullock et al. 1987).
BHB2688	(N205 <i>recA</i> [<i>λimm434 cIts b2 red Eam</i> Sam/λ])	A bacteriophage λ lysogen used to prepare packaging extracts (Hohn and Murray 1977; Hohn 1979).
BHB2690	(N205 <i>recA</i> [<i>λimm434 cIts b2 red Dam</i> Sam/λ])	A bacteriophage λ lysogen used to prepare packaging extracts (Hohn and Murray 1977; Hohn 1979).
BL21(DE3)	<i>hsdS gal</i> (Δ <i>cIts</i> 857 <i>ind1</i> Sam7 <i>nin5</i> <i>lacUV5-T7</i> gene 1)	A strain employed for high-level expression of genes cloned into expression vectors containing bacteriophage T7 promoter. Bacteriophage T7 RNA polymerase is carried on the bacteriophage λ DE3, which is integrated into the chromosome of BL21 (Studier and Moffatt 1986).
BNN102 (C600hflA)	<i>supE44 hsdR thi-1 thr-1 leuB6 lacY1</i> <i>tonA21 hflA150(chr::Tn10(tet^r))</i>	An <i>hflA</i> strain used to select λgt10 recombinants. The high frequency lysogeny mutation suppresses plaque formation by <i>cI⁺</i> bacteriophages but allows plaque formation by recombinant <i>cI⁻</i> bacteriophages (Young and Davis 1983a).
C-1a	A wild-type strain.	A clone of <i>E. coli</i> strain C wild type maintained on minimal medium for several years. <i>E. coli</i> C is F ⁻ and lacks host restriction and modification activity. It is a nonsuppressing host strain used in complementation tests with amber mutants of bacteriophage λ (Bertani and Weigle 1953; Borck et al. 1976).
C600 (BNN93)	<i>supE44 hsdR thi-1 thr-1 leuB6 lacY1</i> <i>tonA21</i>	A suppressing strain often used for making lysates (Appleyard 1954) and for propagation of λgt10 (Young and Davis 1983a).
CES200	<i>sbcB15 recB21 recC22 hsdR</i>	A strain used for growth of Spi ⁻ bacteriophages (Nader et al. 1985).
CES201	<i>recA sbcB15 recB21 recC22 hsdR</i>	A recombination-deficient strain used for growth of Spi ⁻ bacteriophages (Wyman and Wertman 1987).
CJ236	<i>dut1 ung1 thi-1 relA1/pCJ105(cam^r F')</i>	A <i>dut⁻ ung⁻</i> strain used to prepare uracil-containing DNA for site-directed mutagenesis experiments (Kunkel et al. 1987). pCJ105 carries an F' and <i>cam^r</i> ; growth of CJ236 in the presence of chloramphenicol selects for retention of the F'.
CSH18	<i>supE thi Δ(lac-pro)</i> F' [<i>proAB⁺ lacZ⁻</i>]	A suppressing strain used to screen recombinants made in bacteriophage λ vectors carrying a <i>lacZ</i> gene in the stuffer fragments. These vectors give rise to blue plaques in the presence of the chromogenic substrate X-gal; recombinants in which the stuffer fragment has been replaced by foreign DNA give rise to white plaques (Miller 1972; Williams and Blattner 1979).
DH1	<i>supE44 hsdR17 recA1 endA1 gyrA96</i> <i>thi-1 relA1</i>	A recombination-deficient suppressing strain used for plating and growth of plasmids and cosmids (Low 1968; Meselson and Yuan 1968; Hanahan 1983).

TABLE A.2 (continued)

Strain	Genotype	Remarks
DH5	<i>supE44 hsdR17 recA1 endA1 gyrA96 thi-1 relA1</i>	A recombination-deficient suppressing strain used for plating and growth of plasmids and cosmids (Low 1968; Meselson and Yuan 1968; Hanahan 1983). This strain has a higher transformation efficiency than DH1.
DH5 α	<i>supE44 ΔlacU169 (ϕ80 <i>lacZ</i>AM15) hsdR17 recA1 endA1 gyrA96 thi-1 relA1</i>	A recombination-deficient suppressing strain used for plating and growth of plasmids and cosmids. The ϕ 80 <i>lacZ</i> AM15 permits α -complementation with the amino terminus of β -galactosidase encoded in pUC vectors (Hanahan 1983; Bethesda Research Laboratories 1986).
DP50 ^{supF}	<i>supE44 supF58 hsdS3(r_B⁻m_B⁻) dapD8 lacY1 glnV44 Δ(<i>gal-worB</i>)47 tyr-T58 gyrA29 tonA53 Δ(thyA57)</i>	A strain used for isolation and propagation of bacteriophage λ recombinants (Leder et al. 1977; B. Bachmann, pers. comm.).
ED8654	<i>supE supF hsdR metB lacY gal trpR</i>	A suppressing strain commonly used to propagate bacteriophage λ vectors and their recombinants (Borck et al. 1976; Murray et al. 1977).
ED8767	<i>supE44 supF58 hsdS3(r_B⁻m_B⁻) recA56 galK2 galT22 metB1</i>	A recombination-deficient suppressing strain used for propagation of bacteriophage λ vectors (Murray et al. 1977).
HB101	<i>supE44 hsdS20(r_B⁻m_B⁻) recA13 ara-14 proA2 lacY1 galK2 rpsL20 xyl-5 mtl-1</i>	A suppressing strain commonly used for large-scale production of plasmids. It is an <i>E. coli</i> K12 \times <i>E. coli</i> B hybrid that is highly transformable (Boyer and Roulland-Dussoix 1969; Bolivar and Backman 1979).
HMS174	<i>recA1 hsdR rif^r</i>	A recombination-deficient nonsuppressing strain used for high-level expression of genes cloned into expression vectors containing bacteriophage T7 promoter. Bacteriophage T7 RNA polymerase is provided by infection with a bacteriophage λ that carries bacteriophage T7 gene 1 (Campbell et al. 1978; Studier and Moffatt 1986).
JM101 ^a	<i>supE thi Δ(<i>lac-proAB</i>) F' [<i>traD36 proAB⁺ lacI^q lacZ</i>AM15]</i>	A strain that will support growth of vectors carrying amber mutations (Messing 1979).
JM105	<i>supE endA sbcB15 hsdR4 rpsL thi Δ(<i>lac-proAB</i>) F' [<i>traD36 proAB⁺ lacI^q lacZ</i>AM15]</i>	A strain that will support growth of vectors carrying amber mutations and will modify but not restrict transfecting DNA (Yanisch-Perron et al. 1985).
JM107 ^b	<i>supE44 endA1 hsdR17 gyrA96 relA1 thi Δ(<i>lac-proAB</i>) F' [<i>traD36 proAB⁺ lacI^q lacZ</i>AM15]</i>	A strain that will support growth of vectors carrying amber mutations and will modify but not restrict transfecting DNA (Yanisch-Perron et al. 1985).
JM109 ^{b,c}	<i>recA1 supE44 endA1 hsdR17 gyrA96 relA1 thi Δ(<i>lac-proAB</i>) F' [<i>traD36 proAB⁺ lacI^q lacZ</i>AM15]</i>	A recombination-deficient strain that will support growth of vectors carrying amber mutations and will modify but not restrict transfecting DNA (Yanisch-Perron et al. 1985).
JM110	<i>dam⁻ Δcm supE44 hsdR17 thi leu rpsL lacY galK galT ara tonA thr tss Δ(<i>lac-proAB</i>) F' [<i>traD36 proAB⁺ lacI^q lacZ</i>AM15]</i>	A strain that will not modify <i>Bcl</i> I sites and will support growth of vectors carrying amber mutations (Yanisch-Perron et al. 1985).
K802	<i>supE hsdR gal metB</i>	A suppressing strain used to propagate bacteriophage λ vectors and their recombinants (Wood 1966).
KK2186	<i>supE sbcB15 hsdR4 rpsL thi Δ(<i>lac-proAB</i>) F' [<i>traD36 proAB⁺ lacI^q lacZ</i>AM15]</i>	A strain that will support growth of vectors carrying amber mutations and will modify but not restrict transfecting DNA (Zagursky and Berman 1984).

LE392	<i>supE44 supF58 hsdR514 galK2 galT22 metB1 trpR55 lacY1</i> $\Delta(lac-proAB)$	A suppressing strain commonly used to propagate bacteriophage λ vectors and their recombinants. LE392 is a derivative of ED8654 (Borek et al. 1976; Murray et al. 1977).
LC90		A strain in which <i>lacZ</i> is deleted that is used for detection of recombinants expressing β -galactosidase fusion proteins (Guarente and Ptashne 1981).
M5219	<i>lacZ trpA rpsL</i> (λ bio252 <i>cls857</i> Δ H1)	A strain used for regulated expression of genes cloned downstream from the bacteriophage λ <i>P_L</i> promoter. It contains a defective λ prophage that encodes the bacteriophage <i>cls857</i> repressor and N protein, which is an antagonist of transcription termination (Remaut et al. 1981; Shimatake and Rosenberg 1981).
MBM7014.5	<i>hsdR2 mcrB1 zjj202::Tn10(tet^r) araD139 araCU25am ΔlacU169</i>	An <i>mcrB</i> strain used for λ ORF8 primary libraries. Libraries are made with DNA treated with methylases to protect <i>Hind</i> III and <i>Bam</i> HI sites. <i>M.AluI</i> methylase is used to protect <i>Hind</i> III sites since <i>M.Hind</i> III methylase is not available commercially. This strain is defective in the restriction system that recognizes <i>AluI</i> -methylated DNA sites (Raleigh and Wilson 1986).
MC1061	<i>hsdR mcrB araD139 Δ(araABC-leu)7679 ΔlacX74 galU galK rpsL thi</i>	An <i>mcrB</i> strain used for λ ORF8 primary libraries as described for the strain MBM7014.5 (Meissner et al. 1987).
MM294	<i>supE44 hsdR endA1 pro thi</i>	A suppressing strain used for large-scale production of plasmids. It is highly transformable (Meselson and Yuan 1968).
MV1184 ^d	<i>ara Δ(lac-proAB) rpsL thi</i> (ϕ 80 <i>lacZ</i> Δ M15) Δ (<i>srl-recA</i>)306::Tn10(<i>tet^r</i>) F' [<i>traD</i> 36 <i>proAB⁺ lacI^a lacZ</i> Δ M15]	A recombination-deficient strain used to propagate phagemids pUC118/pUC119 and to obtain single-stranded copies of phagemids (Vieira and Messing 1987).
MV1193	Δ (<i>lac-proAB</i>) <i>rpsL thi endA spcB15 hsdR4</i> Δ (<i>srl-recA</i>)306::Tn10(<i>tet^r</i>) F' [<i>traD</i> 36 <i>proAB⁺ lacI^a lacZ</i> Δ M15]	A recombination-deficient strain used to propagate phagemids pUC118/pUC119 and to obtain single-stranded copies of phagemids (Zoller and Smith 1987).
MZ-1	<i>galKΔSattLΔBamN₇N₅₃cls857</i> Δ H1 <i>his ilv bio N⁺</i>	A temperature-sensitive lysogenic strain used as a host for plasmids containing the bacteriophage λ <i>P_L</i> promoter (Nagai and Thøgersen 1984).
NM531	<i>supE supF hsdR trpR lacY recA13 metB gal</i>	A recombination-deficient suppressing strain used for propagation of bacteriophage λ vectors (Arber et al. 1983).
NM538	<i>supF hsdR trpR lacY</i>	A strain used for assay and propagation of bacteriophage λ (Frischauf et al. 1983).
NM539	<i>supF hsdR lacY</i> (P2cox)	A strain used for selection of Spi ⁻ bacteriophages. NM539 is a derivative of NM538 (Frischauf et al. 1983).
Q358	<i>supE hsdR ϕ80^r</i>	A <i>supE</i> host used for growth of bacteriophage λ vectors (Karn et al. 1980).
Q359	<i>supE hsdR ϕ80^r P2</i>	A <i>supE</i> host used to select Spi ⁻ recombinants (Karn et al. 1980).
R594	<i>galK2 galT22 rpsL179 lac⁻</i>	A nonsuppressing strain used as a nonpermissive host for vectors containing amber or ochre mutations (Campbell 1965).
RB791	W3110 <i>lacI^aL8</i>	A strain that makes high levels of <i>lac</i> repressor and is used for inducible expression of genes under the control of the <i>lac</i> and <i>tac</i> promoters (Brent and Ptashne 1981).
RR1	<i>supE44 hsdS20(r_B⁻m_B⁻) ara-14 proA2 lacY1 galK2 rpsL20 xyl-5 mtl-1</i>	A <i>recA⁺</i> derivative of HB101 that can be transformed with high efficiency (Bolivar et al. 1977; Peacock et al. 1981; B. Bachmann, pers. comm.).
SMR10	<i>E. coli C</i> (λ cos2 Δ B <i>xis1 red3 gam</i> am210 <i>cls857 nin5 Sam7</i> / λ)	A bacteriophage λ lysogen used to prepare packaging extracts (Rosenberg 1985).

TABLE A.2 (continued)

Strain	Genotype	Remarks
TAP90	<i>supE44 supF58 hsdR pro leuB thi-1 rpsL lacY1 tonA1 recD1903::mini-tet</i>	A host strain used for production of high-titer bacteriophage λ lysates. This restriction-deficient <i>supE supF</i> strain has a mini-tet insertion in <i>recD</i> , which improves growth of Spi^+ λ bacteriophages (Patterson and Dean 1987).
TG1	<i>supE hsdΔ5 thi Δ(lac-proAB) F' [traD36 proAB⁺ lacI^s lacZΔM15]</i>	An EcoK ⁻ derivative of JM101 that neither modifies nor restricts transfected DNA. It will support growth of vectors carrying amber mutations (Gibson 1984).
TG2	<i>supE hsdΔ5 thi Δ(lac-proAB) Δ(sr1-recA)306::Tn10(tet^r) F' [traD36 proAB⁺ lacI^s lacZΔM15]</i>	A recombination-deficient derivative of TG1 (M. Biggin, pers. comm.).
XL1-Blue	<i>supE44 hsdR17 recA1 endA1 gyrA46 thi relA1 lac F' [proAB⁺ lacI^s lacZΔM15 Tn10(tet^r)]</i>	A recombination-deficient strain that will support the growth of vectors carrying some amber mutations, but not those with the Sam100 mutation (e.g., λ ZAP). Transfected DNA is modified but not restricted. XL1-Blue is used to propagate λ ZAPII recombinants, which are unstable in BB4. The F' in this strain allows blue/white screening on X-gal and permits bacteriophage M13 superinfection (Bullock et al. 1987).
XS101	<i>recA1 hsdR rpoB331 F' [kan]</i>	A recombination-deficient strain that modifies but does not restrict transfected DNA. It carries an episome conferring resistance to kanamycin and is used for growth of phagemids (Levinson et al. 1984).
XS127	<i>gyrA thi rpoB331 Δ(lac-proAB) argE F' [traD36 proAB⁺ lacI^s lacZΔM15]</i>	A strain used for growth of phagemids (Levinson et al. 1984).
Y1089	<i>araD139 ΔlacU169 proA⁺ Δlon rpsL hflA150(chr::Tn10(tet^r)) pMC9</i>	A strain used for protein production from λ gt11 and λ gt18-23 recombinants. Expression of the foreign protein is controlled by the high levels of <i>lac</i> repressor made by pMC9, which carries <i>lacI^s</i> . Y1089 is deficient in the <i>lon</i> protease, which may allow increased stability of the foreign proteins. Lysogens are formed at a high frequency in this strain (Young and Davis 1983b).
Y1090 <i>hsdR</i>	<i>supF hsdR araD139 Δlon ΔlacU169 rpsL trpC22::Tn10(tet^r) pMC9</i>	A strain used for immunological screening of expression libraries and propagation of λ gt11 and λ gt18-23 (Young and Davis 1983b; Jendrisak et al. 1987). Expression of the foreign protein is controlled by the high levels of <i>lac</i> repressor made by pMC9, which carries <i>lacI^s</i> . Detection of proteins toxic to <i>E. coli</i> can be achieved by adding IPTG several hours after initiation of plaque formation. Some proteins are unstable in <i>E. coli</i> . Y1090 <i>hsdR</i> is deficient in the <i>lon</i> protease, which may allow increased stability of antigens for antibody screening. The <i>supF</i> marker suppresses Sam100 to allow cell lysis (Young and Davis 1983b).
YK537	<i>supE44 hsdR hsdM recA1 phoA8 leuB6 thi lacY rpsL20 galK2 ara-14 xyl-5 mtl-1</i>	A recombination-deficient suppressing strain used for regulated expression of genes cloned downstream from the <i>phoA</i> promoter (Oka et al. 1985).

^aStrain JM103 (Messing et al. 1981) is a restrictionless derivative of JM101 that has been used to propagate bacteriophage M13 recombinants. However, some cultivars of JM103 have lost the *hsdR4* mutation (Felton 1983) and are lysogenic for bacteriophage P1 (which codes for its own restriction/modification system). JM103 is therefore no longer recommended as a host for bacteriophage M13 vectors. Strain KK2186 (Zagursky and Berman 1984) is genetically identical to JM103 except that it is nonlysogenic for bacteriophage P1.

^bStrains JM106 and JM108 are identical to JM107 and JM109, respectively, except that they do not carry an F' episome. These strains will not support the growth of bacteriophage M13 but may be used to propagate plasmids. However, JM106 and JM108 do not carry the *lacI^s* marker (normally present on the F' episome) and are therefore unable effectively to suppress the synthesis of potentially toxic products encoded by foreign DNA sequences cloned into plasmids carrying the *lacZ* promoter.

^cStrains JM108 and JM109 are defective for synthesis of bacterial cell walls and form mucoid colonies on minimal media. This does not affect their ability to support the growth of bacteriophage M13.

^dThe original strain of MV1184, constructed by M. Volkert (pers. comm.), did not carry an F' episome. However, the strain of MV1184 distributed by the Messing laboratory clearly carries an F' episome. It is therefore advisable to check strains of MV1184 on their arrival in the laboratory for their ability to support the growth of male-specific bacteriophages.

Molecular Cloning

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